«An Optimization Framework for the Edge/Hub/Cloud computing paradigm»

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Wednesday 3rd of April 2024, 17:00 - 18:00

Room: ΧΩΔ02-013

Abstract: In recent years, there has been a shift towards migrating computational tasks from remote cloud resources to the edge, specifically onto Internet of Things (IoT) devices that are now integrated within the computing infrastructure. This migration aims to alleviate the problem of transferring large volumes of data, leading to reduced network traffic and enabling near real-time decision support at the sensor level, as data are processed physically closer to where they are generated. However, as computation moves towards the edge of the infrastructure, the devices become more limited in terms of resource constraints having, for example, limited energy capacity, computational capability, and memory and storage capacity. These constraints become imperative, especially with the rise of emerging applications like telehealth care and critical infrastructure monitoring, where meeting the imposed deadlines is crucial to avoid system disruptions. This presentation introduces a work that adopts the cloud-edge continuum in a multi-tier hierarchy, yielding the edge/hub/cloud computing paradigm. A mixed integer linear programming based (MILP) optimization framework is proposed, which can deliver the optimal task allocation within the edge/hub/cloud computing paradigm in such a way, that a desired by the designer metric is optimized, such as the overall latency, energy consumption, or reliability of the system, while taking into consideration the requirements of the considered application and the limitations of each device in the system. The proposed framework is evaluated using both real-world and synthetic benchmarks to validate its effectiveness and scalability in optimizing the desired metrics under several constraints. The experimental analysis demonstrates that the framework effectively optimizes performance while allowing designers to explore different architectural structures quickly and efficiently.

Biography: **Andreas Kouloumpris** is currently a Ph.D. Candidate at the Department of Electrical and Computer Engineering at the University of Cyprus and his research interests include, but are not limited to, resource allocation and optimization algorithms, graph theory, and edge and cloud computing. In 2016 he graduated top of his class receiving a B.Sc. degree in Computer Engineering from the Department of Electrical and Computer Engineering of the University of Cyprus. He is a member of ETEK (Cyprus Scientific and Technical Chamber) and a member of the high IQ society MENSA. Andreas was a Researcher at the KIOS Research and Innovation Center of Excellence from 2017 to 2021.